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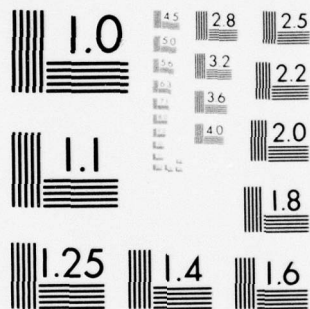
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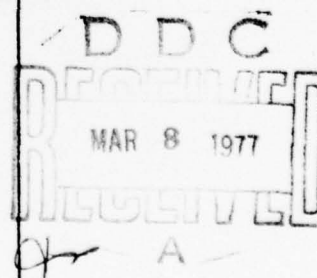


PROGRAM MANAGEMENT COURSE INDIVIDUAL STUDY PROGRAM

LEVERAGE AND PROFITABILITY IN
SELECTED DEFENSE INDUSTRIES

STUDY PROJECT REPORT
PMC 76-2

Richard David Schulman
Commander United States Navy



FORT BELVOIR, VIRGINIA 22060

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DEFENSE SYSTEMS MANAGEMENT COLLEGE

STUDY TITLE:

LEVERAGE AND PROFITABILITY IN SELECTED DEFENSE INDUSTRIES

The object of this study was to

STUDY PROJECT GOALS:

Obtain an understanding of corporate financial structures and ratios using financial reports of twelve major defense contractors as a data base; to determine if correlation exists between the contractor's use of debt (financial leverage) and profitability (net earning/stockholders' equity); and to develop an annotated bibliography of sources of business and financial information. *The author compiled, analyzed and prepared graphical presentations*

STUDY REPORT ABSTRACT:

Preparation for the formal report included:

1. An extensive library search for financial texts, periodicals and handbooks on corporate financial management, including the concepts of leverage and profitability.
2. Compilation, analysis and graphical preparation of financial statistics on twelve defense contractors in five industries: shipbuilding, surface effect ship construction, electronic test instruments, weapons system (diversified) and semiconductor manufacturing.

The formal report is divided into five main sections, a two-part bibliography and three appendices:

1. SECTION I: INTRODUCTION
2. SECTION II: FINANCIAL ANALYSIS
3. SECTION III: SOURCES OF BUSINESS INFORMATION
4. SECTION IV: FINANCIAL LEVERAGE AND PROFITABILITY IN SELECTED DEFENSE INDUSTRIES
5. SECTION V: CONCLUSION
6. BIBLIOGRAPHY
PART I: Works Cited
PART II: Additional Selected Readings
7. APPENDIX A: Corporate Fact Sheets
8. APPENDIX B: Graphical 5 Year Presentation of Leverage and Profitability
9. APPENDIX C: Summary of Rank Correlation of Average Leverage and Variability of Profitability (POE)

Subject Descriptors: Financial Analysis, Leverage, Profitability, Risk, Business Information, Defense Industry, Profit '76.

NAME, RANK, SERVICE
RICHARD D. SCHULMAN
COMMANDER, U.S. NAVY

CLASS

PMC 76-2

DATE

8 NOVEMBER 1976

LEVERAGE AND PROFITABILITY IN

SELECTED DEFENSE INDUSTRIES

Study Project Report

Individual Study Program

Defense Systems Management School

Program Management Course

Class 76-2

by

Richard David Schulman

Commander United States Navy

November 1976

Study Project Advisor

Dr. Benjamin C. Rush

This study project report represents the views, conclusions and recommendations of the author and does not necessarily reflect the official opinion of the Defense Systems Management School or the Department of Defense.

EXECUTIVE SUMMARY

In 1975 Deputy Secretary of Defense, William P. Clements, initiated a major defense study--"Profit '76". This study is illustrative of the Defense Department's intense interest in corporate financial structure, and profitability in the United States Defense Industry.

This independent study project (ISP) provides the reader with the information to understanding "Profit '76" and similar analysis of the industrial financial aspects of Weapons System Acquisition.

The independent study project (ISP) report should benefit the reader in three ways, to wit:

(1) It provides a tutorial on corporate financial structures, reports and ratio analysis.

(2) Future financial decision making and collection of statistics are facilitated by the use of three bibliographies--namely, an annotated listing of sources of business information, a "works cited" list, and an annotated bibliography on leverage and profitability.

(3) Ratio analysis and rank correlations are performed on twelve major defense contractors representing five industries: ship-building, surface effect ship (SES) construction, electronics test instrument, semiconductor manufacturing and weapons systems. The contractors are Litton Industries, Tenneco, Todd Shipyards, Hewlett-Packard, Tektronics, National Semiconductor, Texas Instruments, Inc., Raytheon Company, RCA Corporation, Rockwell, Rohr Industries, Inc. and Textron.

Financial leverage (total debt/total assets) and profitability (net income/stockholders equity) is charted for the period 1971 through 1975 for each corporation.

ACKNOWLEDGEMENTS

The author wishes to express his appreciation to Dr. Benjamin C. Rush, Professor of Financial Management, Defense Systems Management College. Dr. Rush's keen intellect, congenial personality, and thorough comprehension of corporate finance has been a source of inspiration for me throughout this independent study project.

The assistance of Dr. Donald W. Hurta and Mr. J. Stanley Baumgartner, Professors of Engineering Management, DSMC, in providing guidance and source material in the areas of statistics and defense economics is appreciated.

Finally, a special note of gratitude and love to my wife, Lorene, for her usual understanding and support during the many hours of research associated with this project.

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SECTION I

INTRODUCTION

Background

On May 13, 1975 Deputy Secretary of Defense, William P. Clements, initiated a major Defense study--"Project '76":

"The end result of the study effort must be improvements in our profit policy which will directly and favorably act to strengthen our competitive industrial base." (1)

Today, as the "Profit '76" study nears completion, one of the principle investigators, Mr. Dale R. Babione, writes that:

"DOD managers have suspected for some time that the defense industrial base was suffering from a low level of investment, and have attributed that low level in part to a low level of profitability." (2)

The high level of attention and sense of urgency of the "Profit '76" study is evident by the active participation by the Joint Logistics Commander, the Assistant Secretaries of the military departments and ASD(I&L) and ASD (Comptroller). The study team gathered cost and investment data from companies holding defense contracts valued at approximately \$16 Billion. Additional data was collected from 200 other companies.

Purpose and Scope of Report

In order to appreciate the results of the "Profit '76" study, it is necessary to have an understanding of corporate finance and the financial

(1) This notation will be used throughout the report for sources of quotations and major references. The number is the source listed in the bibliography.

posture of the corporations who comprise the U.S. defense industry.

The purpose of this independent study project is threefold:

a. Provide a tutorial on corporate financial structures, reports and ratio analysis.

b. Present selected sources of business and financial information.

c. Examine financial leverage and profitability in a dozen selected defense contractors spread across five defense industry product groups.

Each of the foregoing objectives will be accomplished using literature easily obtainable from public library sources.

SECTION II

FINANCIAL ANALYSIS

A. The Balance Sheet

The key financial statements are the balance sheet and income statement. The balance sheet is a snapshot picture of the value of a firm's assets, and of the claims on these assets at a particular point in time, usually at year end. A simple balance sheet looks like this:

XYZ Corporation Balance Sheet (\$ 000s)
December 31, 1975

Assets

Current Assets (CA)	100
Other Assets (OA)	<u>200</u>
Total Assets (TA)	\$300

Equities

Current Liabilities (CL)	50
Long Term Debt (LTD)	25
Stockholders Equity (SE)	<u>225</u>
Total Equity (TE)	\$300

Assets are arranged in order of decreasing liquidity. Thus, current assets might include cash, accounts receivable and inventories, whereas other assets may consist of plant, equipment and land.

The analysis of this report will focus on the equities portion of the balance sheet. Simply stated, the equities side tells who claims what

proportion of the firm's assets. By accounting convention current liabilities are those accounts, debts or other claims against assets, which are payable within one year. Long term debt includes notes, bonds (debentures) and mortgages whose maturity date does not occur within a year. Total debt (D) would represent the sum of current and long-term debt. Equity, or simply stockholders' equity (SE) represents ownership rights in a company. It is the excess of total tangible assets over total debt (D) and is called net worth.

Preferred and common stock, capital surplus, and retained earnings are conventional forms of equity.

B. The Income Statement

The income or profit and loss statement, unlike the balance sheet, summarizes the profitability of the firm over a period of time. It is extremely useful in analyzing where the firm is making its money. A typical income statement might look like this:

Sales	224
Cost of Goods Sold	(190)
G&A	<u>(20)</u>
Earnings before Interest & Taxes (EBIT)	14
	2
Earnings before Taxes (EBT)	12
Taxes	<u>5</u>
Net Income (NI)	7
Cash Dividend	<u>3</u>
Retained Earnings	4

C. Ratio Analysis

Information displayed in corporate balance sheets and income statements can be interpreted by comparing different items through the use of ratios. The technique of comparing one firm's ratios with those of another firm or with industry or national averages is central to the analysis of a firm's financial well being.

Ratios are not equal in importance; some ratios, as Miller⁽³⁾ suggests, lead and others follow. Separating ratios into a set of leading or causal ratios and a set of followers or effect ratios will facilitate an understanding of the correlation of leverage and profitability. Let's examine Miller's 15 ratios:

Causal:

1. fixed-assets-to-net-worth
2. collection period
3. net-sales-to-inventory
4. net-sales-to-net-worth
5. net-profit-to-net-sales
6. miscellaneous-assets-to-net-worth

Effect:

1. current ratio $\frac{(CA)}{(CL)}$
2. current-liabilities-to-net-worth
3. total-liabilities-to-net-worth
4. inventory-to-working-capital

5. trade-receivables-to-working-capital
6. long-term-debt-to-working-capital
7. net-profit-to-net-worth
8. net-sales-to-fixed-assets
9. net-sales-to-working-capital

Weston (4) describes another way to classify financial ratios:

1. Activity (i.e., inventory turnover, average collection period, total asset turnover)
2. Cost-Structure (gross profit margin, G&A expense, depreciation plus lease rental)
3. Leverage (total-debt-to-total-assets, fixed-charges-coverage or times interest earned)
4. Liquidity (current, quick, profit margin on sales, return-on-total-assets, return-on-net-worth).

D. Financial Leverage and Profitability

One of the key leverage ratios is the relationship between total debt (D) and total assets (TA).

$$\text{Leverage, } L = D/TA$$

Before proceeding with an illustration of leverage at work it may be helpful to create three firms, each with a different degree of leverage.

Assume a firm has 0 financial leverage. In other words, it has no debt financing, therefore all assets are claimed by the stockholders.

Firm A

		D	0
		SE	500
TA	\$500	TE	\$500

A second firm has, say 50% leverage and therefore its financial structure is:

Firm B

	D (at 8% INT)	250
	SE	250
TA	TE	<u>\$500</u>

And a third firm is highly leveraged at say 90%:

Firm C

	D (at 8% INT)	450
	SE	50
TA	TE	<u>\$500</u>

Next, let's create three market conditions for each company, so that the rate of return on assets before interest and taxes is 4%, 8% and 12%.

ROE (before I&T):	4%	8%	12%
therefore EBIT is:	\$20	\$40	\$60
(recall TA = \$500)			

Next, we can reconstruct a simple income statement for each company for each of the three levels of ROI.

Firm A where L = 0%

EBIT	\$20	\$40	\$60
Less interest	0	0	0
EBT	<u>\$20</u>	<u>\$40</u>	<u>\$60</u>
Taxes (50%)	<u>10</u>	<u>20</u>	<u>30</u>
NI	\$10	\$20	\$30
 NI SE	 $\frac{10}{500} = 2\%$	 $\frac{20}{500} = 4\%$	 $\frac{30}{500} = 6\%$

Firm B where L = 50%

EBIT	\$20	\$40	\$60
Less Interest (.08 X 250)	<u>20</u>	<u>20</u>	<u>20</u>
EBT	\$ 0	\$20	\$40
Taxes (50%)	<u>0</u>	<u>10</u>	<u>20</u>
NI	\$ 0	\$10	\$20

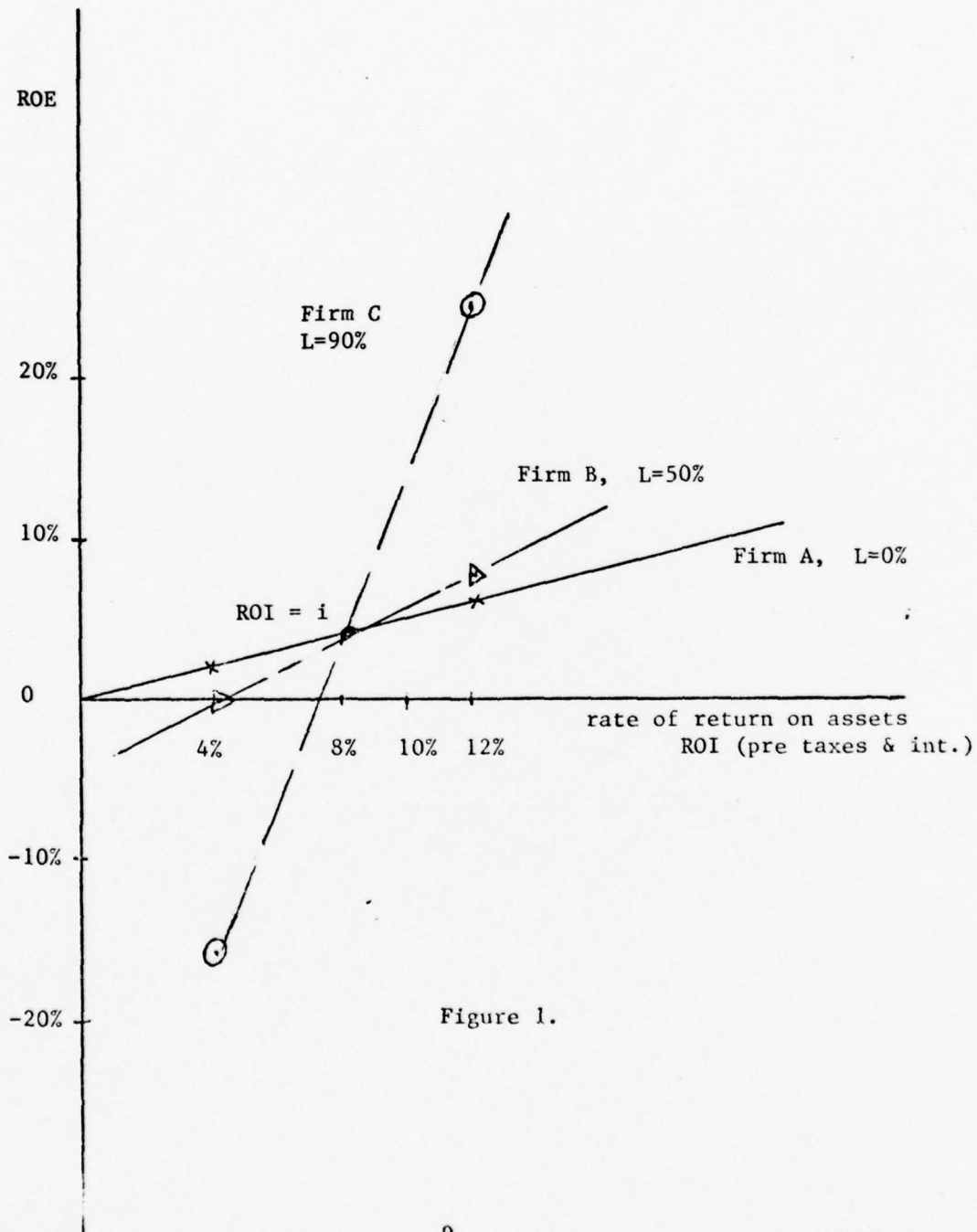
$$ROE = \frac{NI}{SE} \quad 0\% \quad \frac{10}{250} = 4\% \quad \frac{20}{250} = 8\%$$

Firm C where L = 90%

EBIT	\$20	\$40	\$60
Less Interest (.08 X 450)	<u>36</u>	<u>36</u>	<u>36</u>
EBT	(\$16)	\$ 4	\$24
Taxes (50%)	<u>(8)</u>	<u>2</u>	<u>12</u>
NI	(\$ 8)	\$ 2	\$12

$$ROE = \frac{NI}{SE} \quad \frac{(8)}{50} = 16\% \quad \frac{2}{50} = 4\% \quad \frac{12}{50} = 24\%$$

RELATIONSHIP OF ROI AND ROE $f(\text{LEVERAGE})$



There are several assumptions implicit in the foregoing example. First, the tax calculation assumes that losses are carried back and result in tax credits. In order to have favorable financial leverage the interest rate on debt must be less than the firm's ROI, otherwise the firm will lose money on every dollar borrowed at that rate. Another requirement for financial leverage is that ROI not be exactly equal to the debt interest ratio. It is easy to see from Figure 1 that at that point where ROI = interest rate (8%), the trend lines for all three firms cross and the effects of leverage do not occur.

E. Statistical Correlation of Financial Information

In Part IV C of this report, financial data from twelve defense firms is analyzed. The analysis employs several statistical concepts and procedures; specifically:

calculation of mean leverage, \bar{X}

linear regression, L.R.

determination of standard deviation,

Spearman's formula for rank correlation, r rank

In place of a detailed explanation of each concept, a basic definition or formula is given. Additional information on the statistical topics may be found in the reference works cited.

a. mean leverage for the firm:

$$\bar{X} \text{ of } L = \frac{\sum x_i}{n} = \frac{\sum L_t}{n}$$

where L is the leverage ratio for year t, and n is the number of years of data.

- b. linear regression on ROE versus t:

Reference (5) amplifies concept.

L.R. is a statistical method for finding a straight line that best represents or "fits" a set of data points, thus providing a relationship between two variables. The equation for the line is $R = A + Bt$

$$\text{where } A = \frac{\sum R_t \sum t^2 - \sum t \sum R_t}{n \sum t^2 - (\sum t)^2}$$

$$B = \frac{n \sum t R_t - \sum t \sum R_t}{n \sum t^2 - (\sum t)^2}$$

since the values of ROE are equally spaced on the time axis (one year between values), we can say:

$$\bar{R} = \frac{\sum R_t}{n}$$

where n is the number of years for which ROE is available.

- c. Standard deviation, or variability of ROE; (6)

$$\sigma = \sqrt{\frac{\sum R_t^2 - (\sum R_t)^2}{n-1}} = \sqrt{\frac{\sum (R_t - \bar{R})^2}{n-1}}$$

- d. Spearman's formula for Rank Correlation: (7)

In order to relate leverage (cause) to ROE (effect) a ranking procedure is used.

$$r_{\text{rank}} = 1 - \frac{6 \sum D^2}{N(N^2-1)}$$

where D = difference between ranks of corresponding pair values.

N = number of pairs of values $(L, R)_t$ in the data.

SECTION III

SOURCES OF BUSINESS INFORMATION

A. Reference Source Books

Coman, Edwin T., Jr., Sources of Business Information. Rev. ed. Berkley, Los Angeles, University of California. Pr., 1964.

Includes accounting, finance marketing and general management.

Wasserman, Paul, Ed., Encyclopedia of Business Information Sources, Gale Research Company, Book Tower, Detroit, Michigan, 1970.

Comprehensive detailed listing of Periodicals, Organizations, Directories, Handbooks, Bibliographies on a wide range of business management topics. Excellent two volume reference work.

Directory of Business and Financial Services, Special Library Association, 31 E. 10th St., New York, N.Y. 10003.

B. Corporate Financial Statistics

Moody's Industrial Manual, Two Volumes, R. P. Hanson, Editor, Moody's Investor's Service, Inc., 99 Church Street, New York, N.Y. 10007, 1976.

Outstanding source books for recent corporate financial reports.

Poor's Corporate Record, Standard and Poor's Corporation, 345 Hudson St., New York, N.Y. 10014.

Corporation Annual Reports, Direct from individual corporations. Selected firms annual reports available at university and public business and technical libraries.

C. Corporate Structure

Directory of Corporate Affiliations, "Who Owns Whom", National Register Publishing Company, Skokie, Illinois 60076, 1976.

Arranged in two classifications: (1) By parent company, alphabetical; (2) By divisions, subsidiaries and affiliates--parent company.

Thomas' Register of American Manufacturers, Thomas Publishing Company 461 Eighth Avenue, New York, N.Y. 10001.

D. Current Financial Statistics

Financial World, FW Publishing Corporation, 919 Third Avenue, New York, N.Y. 10022. Published semi-monthly.

Includes section on corporate earnings, current public financing calendar, financial summaries, including key business indicators.

Barron's National Business and Financial Weekly, Barron's Publishing Co., 130 Broad Street, New York, N.Y. 10004.

Fortune, Time, Inc., 540 North Michigan Avenue, Chicago, Illinois 60611. Monthly.

Wall Street Journal, Dow Jones and Co., Inc., 30 Broad Street, New York, N.Y. 08540.

E. Basic Finance Theory

Schultz, Raymond G. and Robert E. Schultz, Basic Financial Management, Intext Educational Publishers, Scranton, Pennsylvania, 1972.

Numerous case studies, well formatted.

Weston, J. Fred and Eugene F. Brigham, Essentials of Managerial Finance, The Dryden Press, Hinsdale, Illinois, 1974.

Comprehensive coverage of basic finance.

F. Financial Decisions Methodology

Hampton, John J., Financial Decision Making: Concepts Problems and Cases, Reston Publishing Company, Inc., Reston, VA 22090

Robichek, Alexander A., Ed., Financial Research and Management Decisions, New York, John Wiley and Sons, Inc., 1967.

Conference report, Stanford University.

G. Advanced Finance Theory

Dobrovolsky, Sergei P., The Economics of Corporation Finance, New York, McGraw Hill Book Co., 1971.

Vickers, Douglas, The Theory of the Firm: Production, Capital, and Finance, New York, McGraw Hill Book Co., 1968.

H. Statistical Analysis

Freud, John E. and Frank J. Williams, Elementary Business Statistics, Englewood Cliffs, New Jersey, Prentice-Hall, Inc., 1972.

Spurr, William A. and Charles P. Bonini, Statistical Analysis for Business Decisions, Homewood, Illinois, Richard D. Irwin, Inc., 1973.

Classic reference. Numerous problems.

Wonnacott, Thomas H. and Ronald J., Introductory Statistics for Business and Economics, New York, John Wiley and Sons, Inc., 1972.

Excellent reference. Unusually well illustrated, clear explanation of statistical procedures. Includes solved problem sets.

I. Financial Report Analysis

Miller, Donald E., The Meaningful Interpretation of Financial Statements, New York, The American Management Association, Inc., 1972.

Focuses on the cause and effect approach to evaluating a company's financial soundness.

Hawkins, David F., Financial Reporting Practices of Corporations, Homewood, Illinois, Dow Jones-Irwin, Inc., 1972.

Consists of two parts: (1) The financial information needs of the users of financial statements, and (2) The financial reporting policy decision problems of management.

Annual Statement Studies, Robert Morris Associates, Philadelphia, National Bank Building, Philadelphia, Pennsylvania 19107. Issued yearly.

Standard and Poor's Industry Survey, Standard and Poor's Corporation, 345 Hudson Street, New York, N.Y. 10014. Annual with quarterly revisions.

Basic surveys on 42 industries, includes trends, prices and profits.

Levine, Sumner N., Ed., Financial Analyst's Handbook, Homewood, Illinois, Dow Jones-Irwin, Inc., 1975.

Volume I: Portfolio Management
Volume II: Analysis by Industry

SECTION IV
FINANCIAL LEVERAGE AND PROFITABILITY
IN SELECTED DEFENSE INDUSTRIES

A. Background

A clearer understanding of corporate financial structures and financial structures and financial analysis can be facilitated by applying the theory and procedures of Section II of this report to real corporations. A dozen defense firms, in five industries, were selected to provide a data base for exploring the nature of actual financial reports, and ratio analysis. This data basis provides some insight into the concepts of financial leverage, working capital and profitability.

B. The Data Base

Figure 2 shows the twelve corporations and their 1975 sales. The firms have been placed in five defense industry "affinity groups"; to wit, shipbuilding, electronic test instruments, semi-conductors, weapon systems (diversified), and surface effect ships.

It is important to recognize that the defense industries shown are very loose classifications. Today, most large firms are either conglomerates with numerous subsidiaries, or single corporations with diversified product lines.

<u>CORPORATION</u>	<u>1975 SALES (\$ in Ms)</u>
<u>SHIPBUILDING</u>	
LITTON INDUSTRIES	\$3,433
TENNECO (Incl Newport News Sldg)	4,061
TODD SHIPYARDS	217
<u>ELECTRONIC TEST INSTRUMENTS</u>	
HEWLETT-PACKARD	917
TEKTRONICS	337
<u>SEMICONDUCTORS</u>	
NATIONAL SEMICONDUCTOR	237
TEXAS INSTRUMENTS	1,368
<u>WEAPONS SYSTEMS (DIVERSIFIED)</u>	
RAYTHEON	2,245
RCA	4,790
ROCKWELL-INTERNATIONAL	4,943
<u>SURFACE EFFECTS SHIPS (SES)</u>	
ROHR INDUSTRIES	449
TEXTRON (Incl Bell Aerospace)	2,459

Figure 2

A closer look at one of the five categories, Shipbuilding, will illustrate the point.

<u>CORPORATION</u>	<u>PRODUCT GROUP</u>	<u>1975 SALES</u> <u>(\$ 000)</u>	<u>% TOTAL SALES</u>
LITTON INDUSTRIES	Business Systems & Equip	1,039	30%
	Defense & Marine Systems	1,222	35%
	Industrial Sys & Equip	668	20%
	Professional Svs & Equip	526	15%

Subsidiaries include Litton Business Systems, Litton Educational Publishing Co, Litton Medical Products, Microwave Cooking Products, Western Geophysical Co. of America.

TENNECO CORPORATION	Machinery, Equip & Shpbldg	1,627	40%
	Chemicals	316	8%
	Packaging	373	9.3%
	Refined Products	846	21%
	Land Use	138	3.4%
	Purchase Crude	154	4%
	Pipeline Gas	193	5%
	Produced Crude	294	7.3%
	Other	77	2%

Subsidiaries include Tenneco Chemical, Inc., Packaging Corp of America, Republic of Texas Corp, Philadelphia Life Insurance Co. and Newport News Shipbuilding & Drydock Co.

<u>CORPORATION</u>	<u>PRODUCT GROUP</u>	<u>1975 SALES</u> <u>(\$ 000)</u>	<u>% TOTAL SALES</u>
TODD SHIPYARDS CORP	Shipbuilding, ship repair, & heavy steel fabrication	\$217	100%

Note: Todd divested itself of a plastic-products subsidiary and Lester Engineering Co. in late 1975.

Todd, Litton and Tenneco all compete for naval and commercial surface ship contracts. Of the three corporations, only Todd can be classified as confining its business to shipbuilding. Nine of the eleven major U.S. shipbuilders are subsidiaries or divisions of a conglomerate like Litton Industries and Tenneco.

A similar analysis could be presented for the other four industrial categories.

C. Financial Reports and Ratio Analysis

Consolidated balance sheets and income statements were reconstructed from data presented in Moody's Industrial Manuals, 1976 and 1974, and Poor's Corporate Record, 1976. The statements were developed as outlined in Section IIA and IIB of this report.

A fact sheet was prepared on each of the twelve corporations for years 1971 through 1975. (See Appendix A.)

In addition to a reconstructed balance sheet, each fact sheet presents a summary of the author's calculation of:

total debt (current liabilities and long term debt), D
financial leverage ratio, L

net income, NI

return on equity, ROE

working capital, WC

Long-term-debt-to-working-capital-ratio

D. Graphical Presentation of Leverage and Profitability

Using information from the corporate fact sheets, a graphical presentation of financial leverage and profitability (ROE) were plotted for years 1971 - 1975 for each corporation. Leverage and profitabilities trends are apparent from the twelve graphical presentations in Appendix B.

E. Rank Correlation of Financial Leverage and Variability of Profitability (ROE)

Using the statistical techniques described in Section IIE, a linear regression by least-squares analysis was performed on the ROE data for each corporation, and the average leverage was determined for the five year period. Next, the rank correlation method was used to establish the existence of correlation between leverage and risk. Where risk is defined as the variability of profitability.

Rank correlation calculations are shown in Appendix C. A summary of the rank correlation calculation follows:

All corporations ranked: $r_{\text{rank}} = .4476$

Nine selected corporations: $r_{\text{rank}} = .6500$

SECTION V

CONCLUSION

Assessment of Financial Risk

Assessment of financial risk* is the underlying reason for studying the historical relationship between leverage and profitability. Financial risk is the chance that a firm will not be sufficiently profitable either to cover interest payments on its debt or to pay dividends to shareholders. If a firm falls short of its profit goals, it may be able to cover operating expenses but not the financing cost of its original investment. The potential amplification of net income using leverage was illustrated in Section IIId. This advantage may be offset by the potential for amplified losses.

It is the role of the financial manager and the chief operating officer of a corporation to weigh potential return against financial risk. In theory, any firm which increases its leverage should expect to have a return of sufficiently higher profits to compensate for the risk of amplified decreases in profits or even amplified losses.

Corporations assume greater debt for many reasons. Theoretically, leverage is increased to amplify returns on stockholders' equity. Often, leverage may be raised or kept at a high level when the firm can least afford to take the financial risk of insolvency. A case in point is

* Another type of risk is Business Risk, the chance that a firm will not have the ability to operate successfully in the business environment. Many business or operating factors contribute to this risk including slumping sales and faulty production machinery.

Todd Shipyards whose 1975 leverage is 90.3%, up dramatically from 53% a year earlier. The fixed charges on this debt will drastically reduce future profits. But what are the corporate choices? Issuance of more stock is difficult, when the stock price is depressed and the short term prospect for reasonable dividends is slight.

There are other forces at work which suppress management decisions for higher leverage. National Semiconductor, for example, has achieved an almost 20% average ROE during the last five years and leverage has remained relatively constant, about 53%. It appears, from a review of National's five year balance sheet, that in spite of dramatic corporate growth (almost 700%), management has maintained a balance between debt and equity. This highlights another aspect of leverage, the desire of management to retain control. Since a profitable company increases profitability from the use of debt, provided the rate of return exceeds the debt interest rate, why not increase the leverage, by management decision, to eighty or ninety percent? The answer is that once growth slows or reaches a steady state, the fixed charges of long term debt still must be paid. Management then loses flexibility. A corporation with lower leverage can decide in any given year whether to pay dividends to stockholders; financial flexibility is probably the underlying reason for National Semiconductor's decision to hold down debt.

Profitability and Diversification

The twelve defense firms selected for the data base were not selected because they represent a cross section of the defense industry.

They were selected as examples of large corporations who manufacture products in five industry classifications of interest to the author. The subsequent analysis of the financial and corporate histories for each firm revealed that not only were most of the corporations within the assigned industry classification not "in those industries" - a majority of their business was non-defense oriented. Litton, Tenneco, Raytheon, RCA, and Textron receive most of their revenues from non-defense sources. It is recommended that a future investigation of the correlation between leverage and profitability in selected defense industries start from an analysis of the product-market makeup of each firm. Only then should the firm be type classified. Many of the firms probably elude classification, either because they or their subsidiaries were widely diversified in product lines, or because the financial information on the diversified product-market categories was not publically available. The effects of leverage on profitability, and analysis of financial risk is near impossible without adequate corporate data.

The tightly controlled ROE ($\bar{V} = .99\%$) for Textron highlights the point that diversification can, if properly done, reduce total risk. A study of Textron's numerous subsidiaries might reveal some sharp loss or profit in individual profit centers, the parent's corporate management has succeeded in achieving impressive profits, a nearly constant 14% ROE, at a reasonable 50% leverage.

Until recently public corporations were allowed to mask the revenues and expenses of individual profit centers. Investor pressure and the

trend to more openness in government and business has made more of this financial data publically available. Revelation of such data will allow the financial analyst to better assess the relationship between leverage, risk, and profitability in selected industries.

Leverage and Profitability by Defense Industry

It would be impressive to demonstrate perfect correlation between leverage and risk for each company within each industry, i.e., shipbuilding, electronics test instruments, etc. However, comparison of the rank order of the firms in the same group reveals little correlation between amount of leverage and the variability of return on stockholders' equity. This lack of correlation may be attributed to four reasons: (1) The fact that firms are principally in other product-market groups than shown, (2) The profits or losses resulting from business risks have swamped out fluctuations due to financial risk, (3) Changes in accounting procedures, write-offs and other reporting mechanisms have caused variation in resulting data, and (4) The corporations are so large and diversified (e.g., Textron) that the effects of leverage on individual defense profit centers, such as Bell Aerospace, are obscured.

Leverage Level by Defense Industry

When leverage is considered in terms of financial risk, it follows that an optimum balance could be reached wherein market conditions, type of product, nature of buyers, available and cost of capital, availability of raw materials, and similar parameters would lead management to select

or strive for a specific leverage for these companies. Faced with the same conditions, firms with similar product-market mixes should maintain about the same level of leverage. (8) Deviations in profits would then reflect the operating efficiency of the firm. Of the twelve firms chosen, only Hewlett-Packard and Tektronics have a strong similarity in total market-product mix. Although this has begun to change in recent years as Hewlett-Packard moves more heavily into consumer oriented electronics. Not surprising is the fact that both companies maintain approximately the same level of leverage--27.2% and 26.4%, respectively. In contrast, Todd and Tenneco, although listed in the same industry grouping, have different product-market mixes and we should conclude that the identical level of leverage is coincidental. Similarly, RCA and Rohr have five year average leverages of 67.7%, yet one is in electronics and the other in metal fabrication (transportation vehicles, SES, air frames).

In conclusion, an analysis of defense contractors with similar product-market mixes should reveal similar degrees of leverage or identifiable reasons for deviations from a group norm.

Closing Remarks

The goals of the study project have been achieved, specifically:

- a. Basic financial analysis was presented.
- b. A summary of important business and financial information sources was developed.
- c. Real defense contractor's financial reports were analyzed and consolidated financial statements presented.

d. The interrelation of leverage and profitability was explored.

e. A bibliography was assembled which should provide a foundation for further research.

In addition, the author concludes that leverage and financial risk have a direct impact on the management policies of defense firms. The amount of risk a company's management is willing to take is a function of both the expected return (ROE) and the company's present financial posture, including the degree of leverage.

In summary, it is felt that the reader should, at the very least, now be able to tackle more detailed and revealing financial analyses on any public corporation using readily available library reference material.

APPENDIX A

LITTON INDUSTRIES

(\$ M)

	1975	1974	1973	1972	1971
CA	\$1,461	\$1,485	\$1,443	\$1,317	\$1,238
<u>OA</u>	725	715	673	740	738
TA	\$2,186	\$2,200	\$2,116	\$2,057	\$1,976
CL	702	736	679	606	526
LTD	678	695	601	642	636
<u>SE</u>	806	769	836	809	814
TE	\$2,186	\$2,200	\$2,116	\$2,057	\$1,976
D	\$1,380	\$1,431	\$1,280	\$1,248	\$1,162
<u>D</u> TA	63.1%	65.0%	60.5%	60.7%	58.8%
NI	\$35.2	dr\$39.8	\$43.0	\$1.1	\$50.0
<u>NI</u> SE	4.4%	-5.2%	5.14%	0.1%	6.14%
WC	\$759	\$749	\$763	\$712	\$712
<u>LTD</u> WC	89%	93%	78.7%	90.17%	89.3%

TENNECO

(\$ M)

	1975	1974	1973	1972	1971
CA	\$1,274	\$1,291	\$1,056	\$ 837	\$ 901
<u>OA</u>	2,706	2,605	2,086	2,098	2,077
TA	\$3,980	\$3,896	\$3,142	\$2,935	\$2,978
CL	1,241	1,151	727	529	558
LTD	1,098	1,159	974	1,012	1,082
<u>SE</u>	1,641	1,586	1,441	1,394	1,338
TE	\$3,980	\$3,896	\$3,142	\$2,935	\$2,978
D	\$2,339	\$2,310	\$1,701	\$1,541	\$1,640
<u>D</u> TA	58.8%	59.3%	54.1%	52.5%	55.1%
NI	\$ 225	\$ 257	\$ 136	\$ 103	\$ 95
<u>NI</u> SE	13.7%	16.2%	9.4%	7.4%	7.1%
WC	\$33	\$140	\$329	\$308	\$343
<u>LTD</u> WC	330%	828%	296%	329%	316%

TODD SHIPYARDS CORPORATION

(\$ M)

	1975	1974	1973	1972	1971
CA	\$78.0	\$78.0	\$65.9	\$56.1	\$52.8
<u>OA</u>	43.2	40.6	42.1	49.9	43.3
TA	\$121.2	\$118.6	\$108.0	\$106.0	\$96.1
CL	47.5	50.1	39.8	36.6	21.5
LTD	61.9	13.3	14.0	14.3	15.1
<u>SE</u>	11.8	55.2	54.2	55.1	59.5
TE	\$121.2	\$118.6	\$108.0	\$106.0	\$ 96.1
D	\$109.4	\$ 63.4	\$ 53.8	\$ 50.9	\$ 36.6
<u>D</u> <u>TA</u>	90.3%	53.5%	49.8%	48.0%	38.1%
NI	d\$43.36	\$1.01	\$0.29	d\$3.12	\$.063
<u>NI</u> <u>SE</u>	-36.8%	+1.8%	+ .5%	- 5.7%	+ .1%
WC	\$30.5	\$37.9	\$26.1	\$19.5	\$31.3
<u>LTD</u> <u>WC</u>	203%	35%	54%	73%	48%

HEWLETT-PACKARD COMPANY

(\$ M)

	1975	1974	1973	1972	1971
CA	\$499.0	\$416.5	\$395.2	\$262.5	\$193.9
<u>OA</u>	268.0	237.9	184.5	121.0	100.6
TA	\$767.7	\$654.4	\$579.7	\$383.5	\$294.5
CL	179.3	179.3	220.8	95.7	60.3
LTD	4.9	2.9	2.2	4.1	1.3
<u>SE</u>	583.5	472.2	356.7	283.7	232.9
TE	\$767.7	\$654.4	\$579.7	\$383.5	\$294.5
D	\$184.2	\$182.2	\$223.0	\$ 99.8	\$ 61.6
<u>D</u> TA	24%	28%	38%	26%	20%
NI	\$83.6	\$84.0	\$50.7	\$38.5	\$23.9
<u>NI</u> SE	10.8%	12.8%	14.2%	13.6%	10.3%
WC	\$320	\$237	\$174	\$167	\$134
<u>LTD</u> WC	1.5%	1.2%	1.3%	2.5%	1.0%

TEKTRONICS

(\$ M)

	1975	1974	1973	1972	1971
CA	\$217	\$176	\$151	\$146	\$117
<u>OA</u>	90	75	56	54	52
TA	\$307	\$251	\$207	\$200	\$169
CL	63.6	68.5	46.6	49.2	33.2
LTD	40.7	7.1	4.3	.9	1.1
<u>SE</u>	202.7	180.4	156.1	169.9	134.7
TE	\$307	\$251	\$207	\$220	\$169
D	\$104.3	\$ 75.6	\$ 50.9	\$ 50.1	\$ 34.3
<u>D</u> TA	34.0%	30.1%	24.6%	22.8%	20.3%
NI	\$26.3	\$21.4	\$16.7	\$15.7	\$11.2
<u>NI</u> SE	13.0%	11.9%	10.7%	9.2%	8.3%
WC	\$153	\$108	\$104	\$ 96.7	\$83.7
<u>LTD</u> WC	26%	7%	4%	0.9%	1.3%

NATIONAL SEMICONDUCTOR

(\$ M)

	1975	1974	1973	1972	1971
CA	\$ 85.0	\$ 61.2	\$ 32.1	\$ 18.2	\$ 11.5
<u>OA</u>	50.4	39.2	21.3	13.5	10.3
TA	\$135.4	\$100.4	\$ 53.4	\$ 31.7	\$ 21.8
CL	39.5	33.6	18.1	11.2	5.3
LTD	27.6	19.7	8.0	7.5	6.4
<u>SE</u>	68.3	47.1	27.3	13.1	10.1
TE	\$135.4	\$100.4	\$ 53.4	\$ 31.8	\$ 21.8
D	\$ 67.1	\$ 53.3	\$ 26.1	\$ 18.7	\$ 11.7
<u>D</u> TA	49.5%	53.1%	48.9%	58.8%	53.7%
NI	\$16.75	\$16.37	\$ 3.72	\$ 2.04	\$ 1.10
<u>NI</u> SE	24.5%	34.8%	13.6%	15.6%	10.9%
WC	\$45.5	\$27.6	\$14.0	\$ 7.0	\$ 6.2
<u>LTD</u> WC	60%	71%	57%	107%	103%

TEXAS INSTRUMENTS, INC.

(\$ M)

	1975	1974	1973	1972	1971
CA	\$663	\$656	\$590	\$470.2	\$405.8
<u>OA</u>	278	309	238	163.8	165.2
TA	\$941	\$965	\$828	\$634	\$571
CL	301	342	283	188	144
LTD	48	73	68	72	95
<u>SE</u>	592	550	477	369	329
TE	\$941	\$965	\$828	\$634	\$571
D	\$349	\$415	\$351	\$260	\$239
<u>D</u> TA	37.1%	43.0%	42.4%	41.0%	41.9%
NI	\$ 62.1	\$ 89.6	\$83.2	\$ 48.0	\$ 33.7
<u>NI</u> SE	10.5%	16.3%	17.4%	13.0%	10.2%
WC	\$362	\$314	\$307	\$282	\$261
<u>LTD</u> WC	13%	23%	22%	26%	36%

RAYTHEON COMPANY

(\$ M)

	1975	1974	1973	1972	1971
CA	\$752	\$693	\$513	\$449	\$442
<u>OA</u>	279	225	193	182	171
TA	\$1031	\$918	\$706	\$631	\$613
CL	476	431	267	213	234
LTD	91	84	83	82	87
<u>SE</u>					
TE	\$1031	\$918	\$706	\$631	\$613
D	\$567	\$515	\$350	\$295	\$321
<u>D</u>					
TA	55%	56%	50%	88%	52%
NI	\$70.9	\$57.8	\$46.2	\$41.2	\$35.2
<u>NI</u>					
SE	15.3%	14.3%	13.0%	12.3%	12.1%
WC	\$256	\$262	\$247	\$236	\$208
<u>LTD</u>					
WC	36%	32%	34%	35%	42%

RCA CORPORATION

(\$ M)

	1975	1974	1973	1972	1971
CA	\$2,046	\$2,098	\$1,835	\$1,807	\$1,677
<u>OA</u>	1,682	1,549	1,466	1,330	1,345
TA	\$3,728	\$3,647	\$3,301	\$3,137	\$3,022
CL	1,287	1,156	1,141	1,095	1,164
LTD	1,261	1,156	1,141	1,095	1,164
<u>SE</u>	1,180	1,150	1,117	1,016	935
TE	\$3,728	\$3,647	\$3,301	\$3,137	\$3,022
D	\$2,548	\$2,470	\$2,184	\$2,121	\$2,087
<u>D</u> TA	68.3%	67.7%	66.2%	67.6%	69.1%
NI	\$110	\$113	\$184	\$158	\$ 94*
<u>NI</u> SE	9.32%	9/85%	16.45%	16.56%	10.07%
WC	\$ 760	\$ 785	\$ 782	\$ 781	\$ 754
<u>LTD</u> WC	166%	143%	146%	140%	154%

*1971 Extraordinary loss not shown
RCA Computer discontinued - 1971

ROCKWELL

(\$ M)

	1975	1974	1973	1972	1971
CA	\$1,806	\$1,977	\$1,199	\$1,027	\$ 781
<u>OA</u>	1,082	1,066	804	713	600
TA	\$2,888	\$3,043	\$2,003	\$1,740	\$1,381
CL	980	1,291	669	462	344
LTD	781	649	382	348	277
<u>SE</u>	1,127	1,103	952	930	760
TE	\$2,888	\$3,043	\$2,003	\$1,740	\$1,381
D	\$1,761	\$1,940	\$1,051	\$ 810	\$ 621
<u>D</u>	61%	63%	52%	47%	45%
TA					
NI	\$101	\$130	\$131	\$77.9	\$68.6
<u>NI</u>	9.0%	11.8%	13.8%	8.4%	9.0%
SE					
WC	\$ 826	\$ 769	\$ 530	\$ 565	\$ 436
<u>LTD</u>	94%	84%	72%	62%	64%
WC					

ROHR INDUSTRIES, INC.

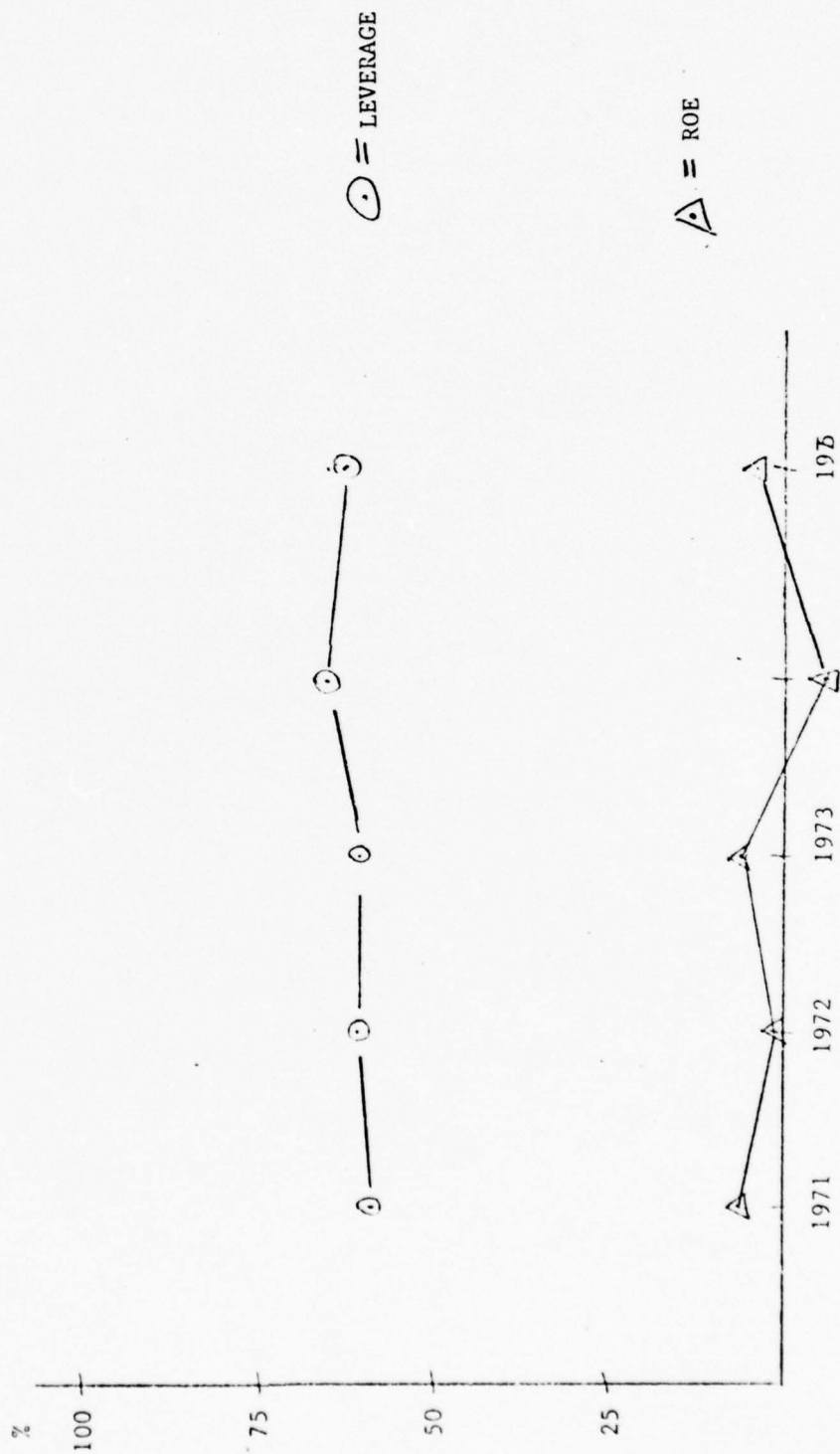
(\$ M)

	1975	1974	1973	1972	1971
CA	\$ 261	\$ 238	\$ 190	\$ 177	\$ 163
<u>OA</u>	53	48	43	41	44
TA	\$ 314	\$ 286	\$ 233	\$ 218	\$ 207
CL	75	147	97	109	100
LTD	164	54	55	31	30
<u>SE</u>	75	85	81	78	77
TE	\$ 314	\$ 286	\$ 233	\$ 218	\$ 207
D	\$ 239	\$ 201	\$ 152	\$ 140	\$ 130
<u>D</u> TA	76.1%	70.2%	65.2%	64.2%	62.8%
NI	dr \$7.6	\$7.7	\$5.8	\$5.0	\$4.6
<u>NI</u> SE	- 10.1%	9.1%	7.1%	6.4%	5.9%
WC	\$ 186	\$ 91	\$ 93	\$ 68	\$ 63
<u>LTD</u> WC	88%	59%	59%	47%	47%

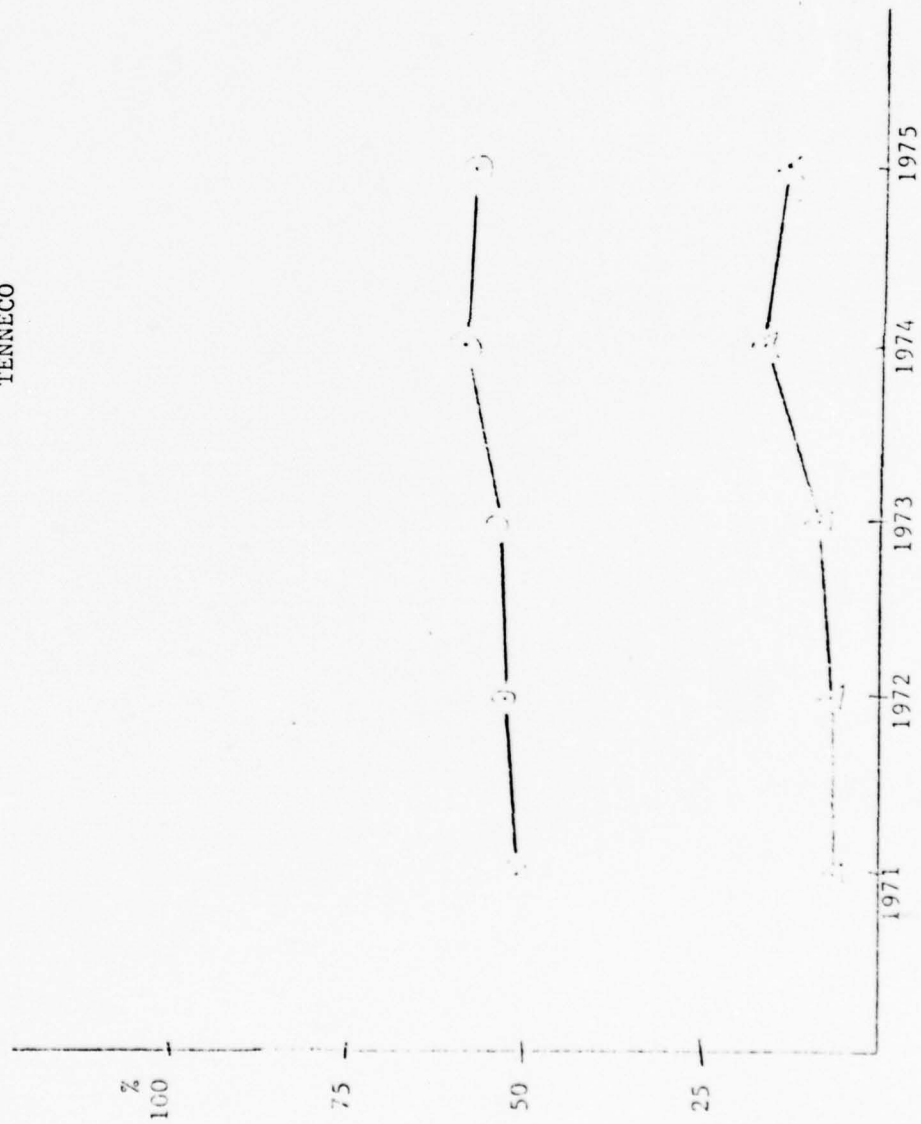
TEXTRON, INC.
(\$ M)

	1975	1974	1973	1972	1971
<u>CA</u>	\$ 971	\$1,012	\$ 854	\$ 728	\$ 652
<u>OA</u>	462	439	456	387	321
TA	\$1,433	\$1,451	\$1,310	\$1,115	\$ 973
CL	398	455	391	297	285
LTD	281	298	250	235	162
<u>SE</u>	754	698	669	585	526
TE	\$1,433	\$1,451	\$1,310	\$1,115	\$ 973
D	\$ 679	\$ 753	\$ 641	\$ 532	\$ 447
<u>D</u>					
TA	47.4%	51.9%	48.9%	47.4%	46.9%
NI	\$ 96.0	\$ 98.2	\$103.6	\$ 88.6	\$ 77.4
<u>NI</u>					
SE	12.72%	14.07%	15.48%	14.08%	13.67%
WC	\$ 573	\$ 557	\$ 464	\$ 430	\$ 367
<u>LTD</u>					
WC	49%	54%	54%	55%	44%

LITTON INDUSTRIES



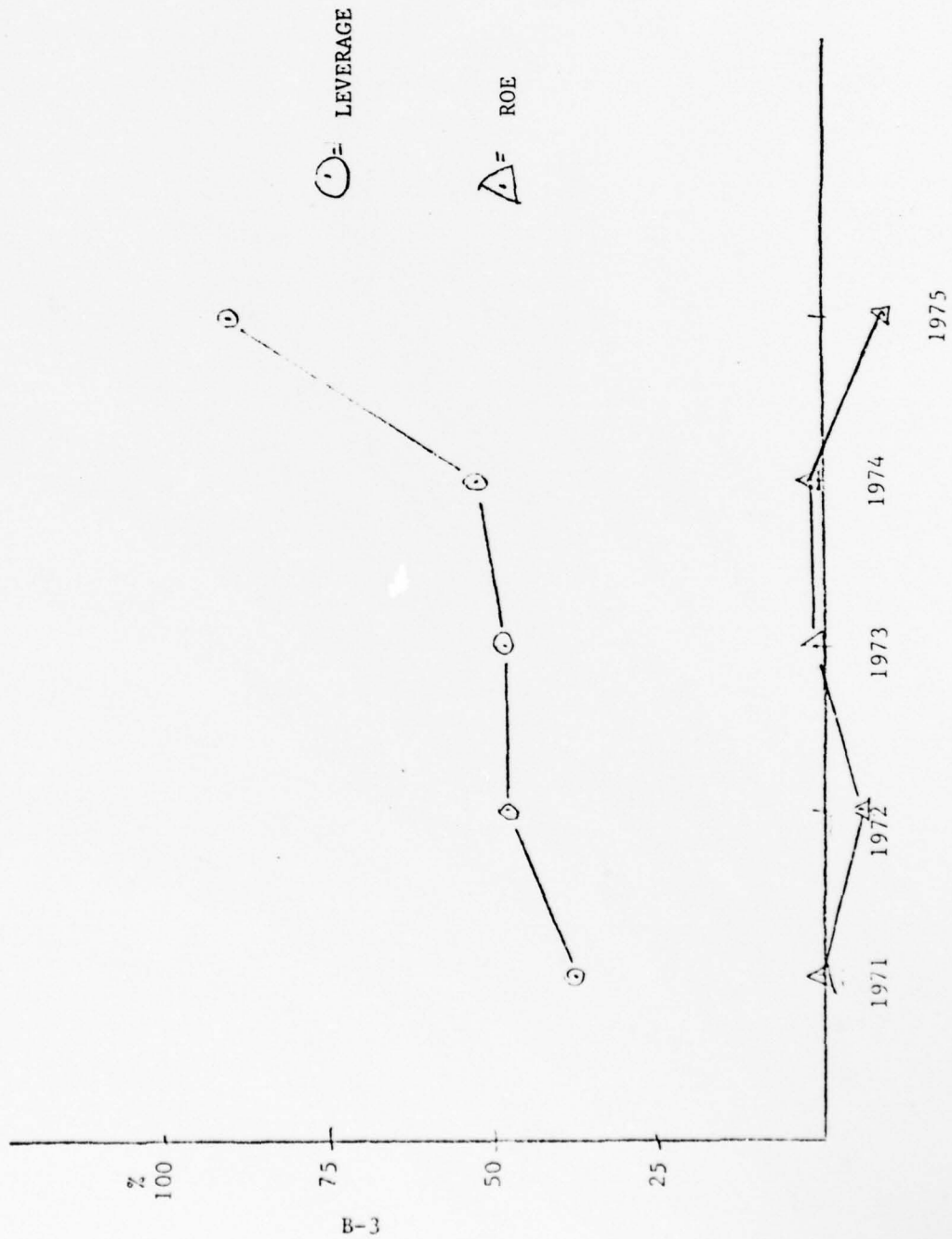
TENNECO



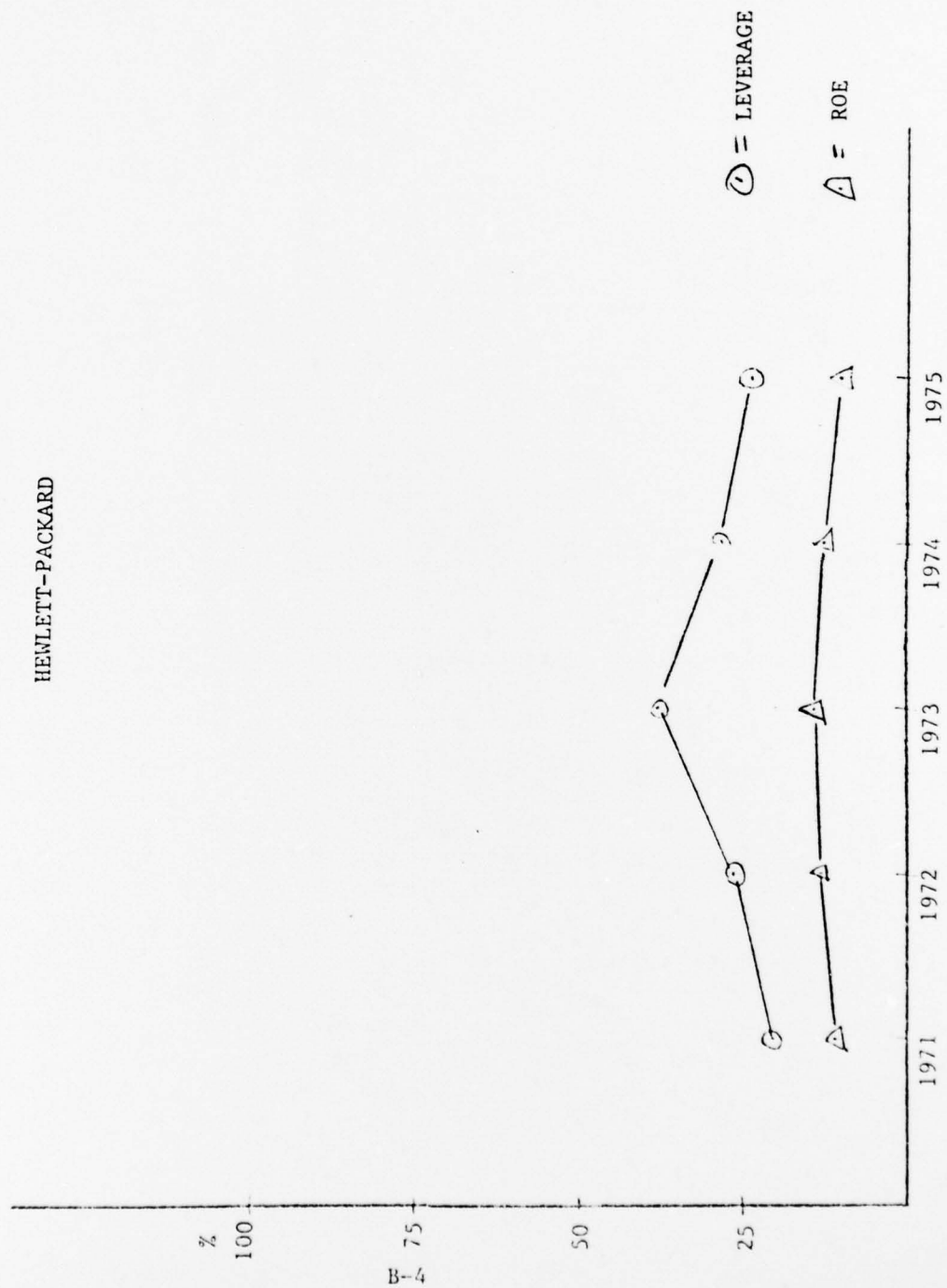
○ = LEVERAGE

□ = ROE

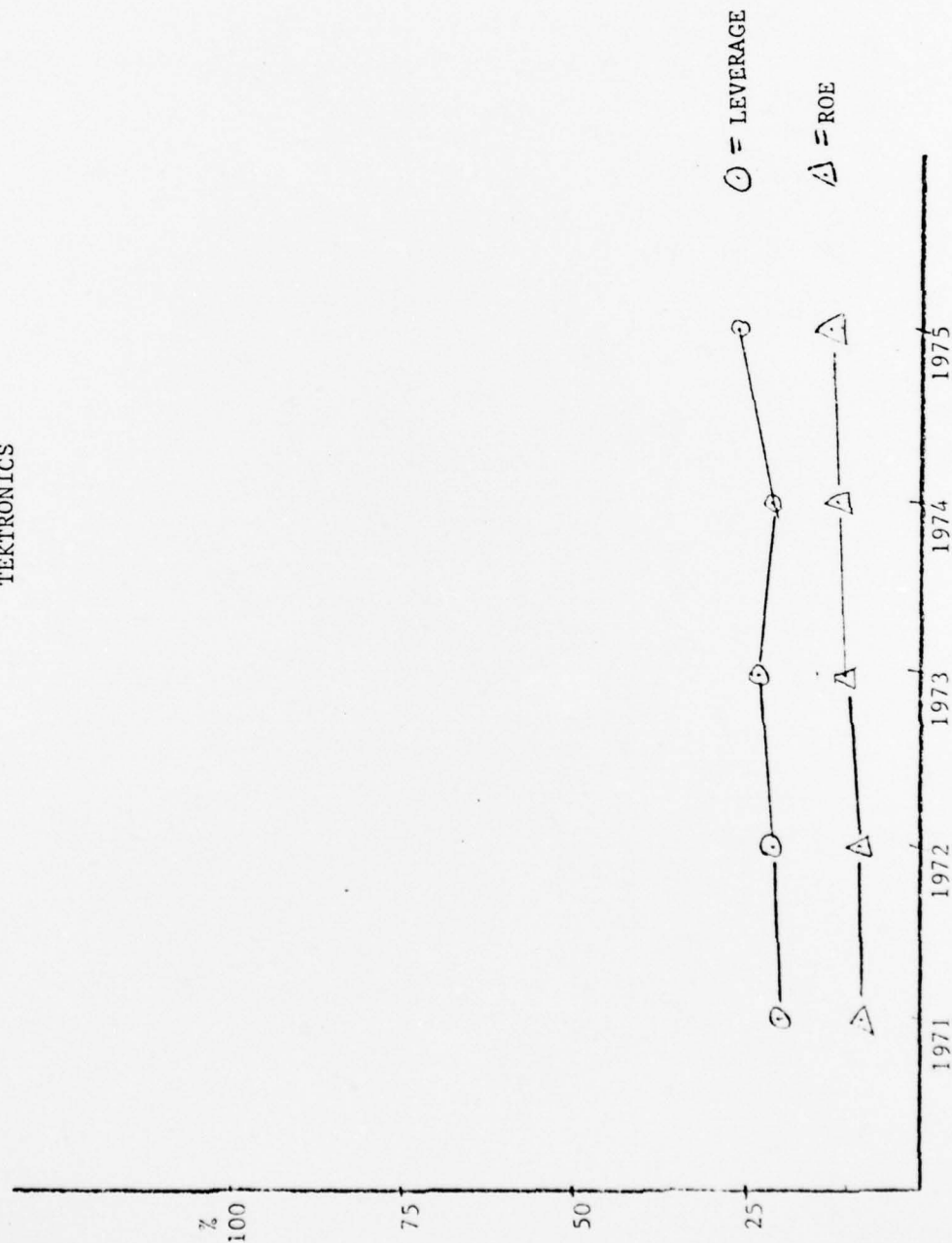
TODD SHIPYARDS



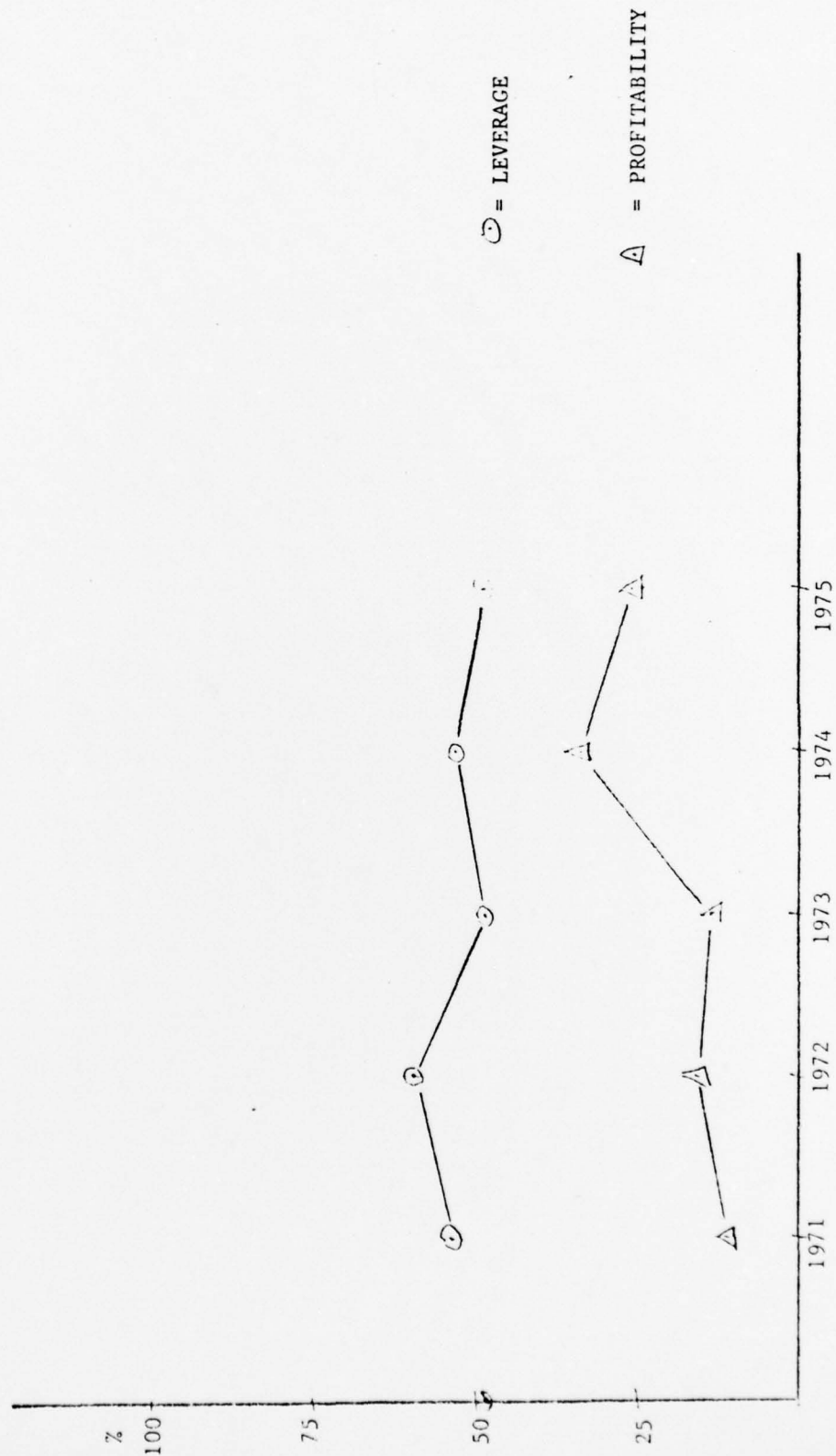
HEWLETT-PACKARD



TEKTRONICS



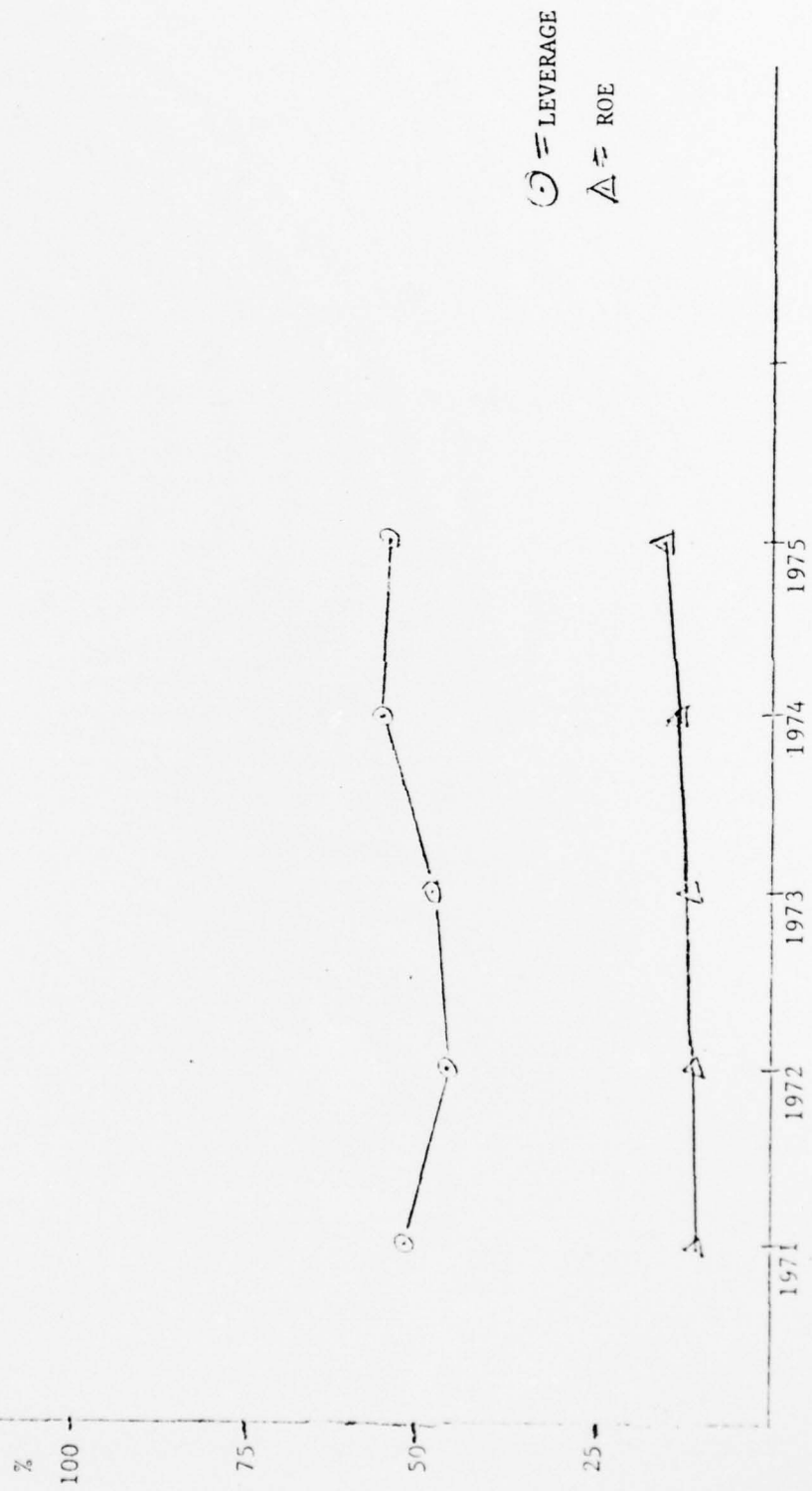
NATIONAL SEMICONDUCTOR



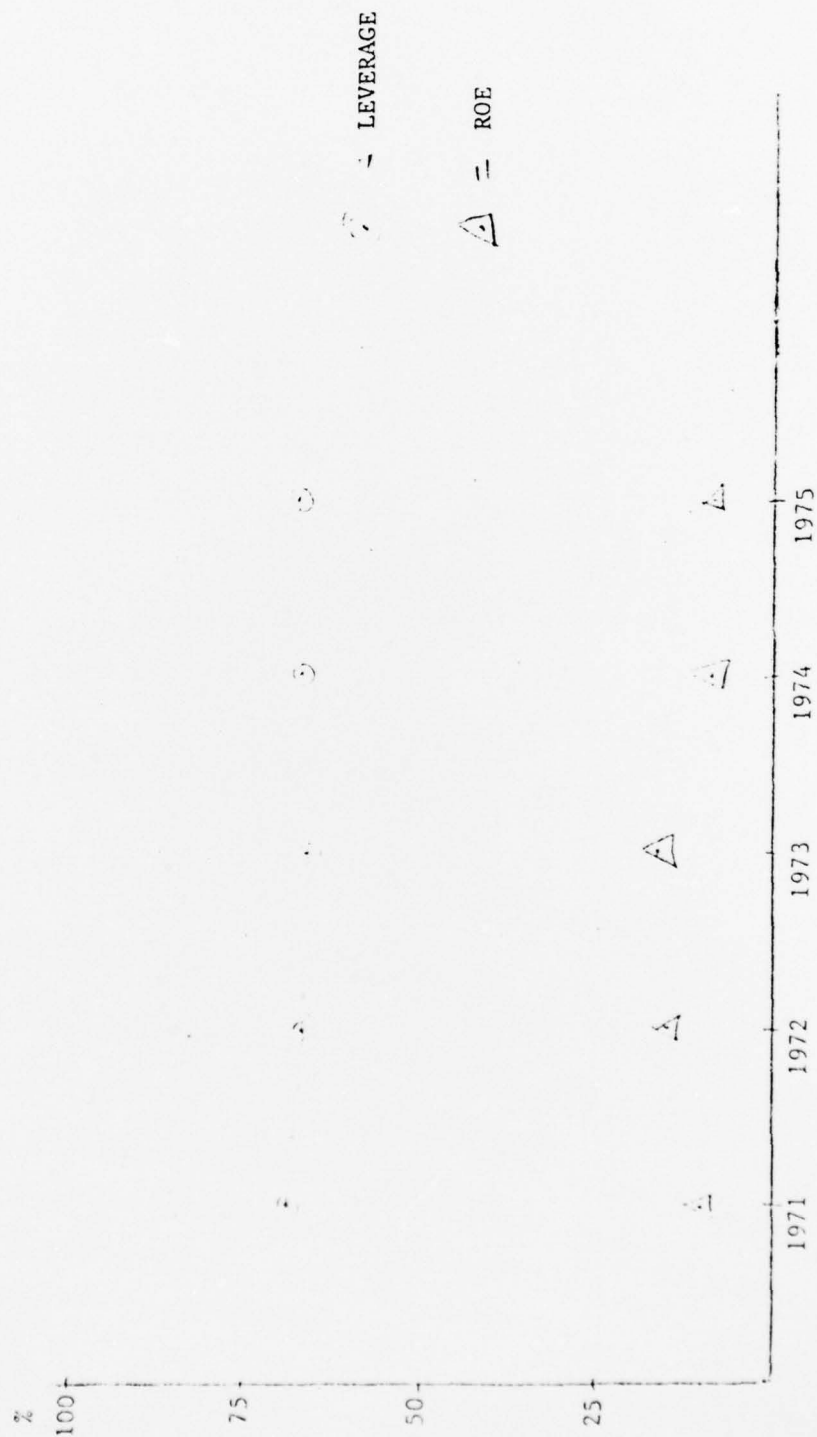
TEXAS INSTRUMENTS, INC.



RAYTHEON COMPANY



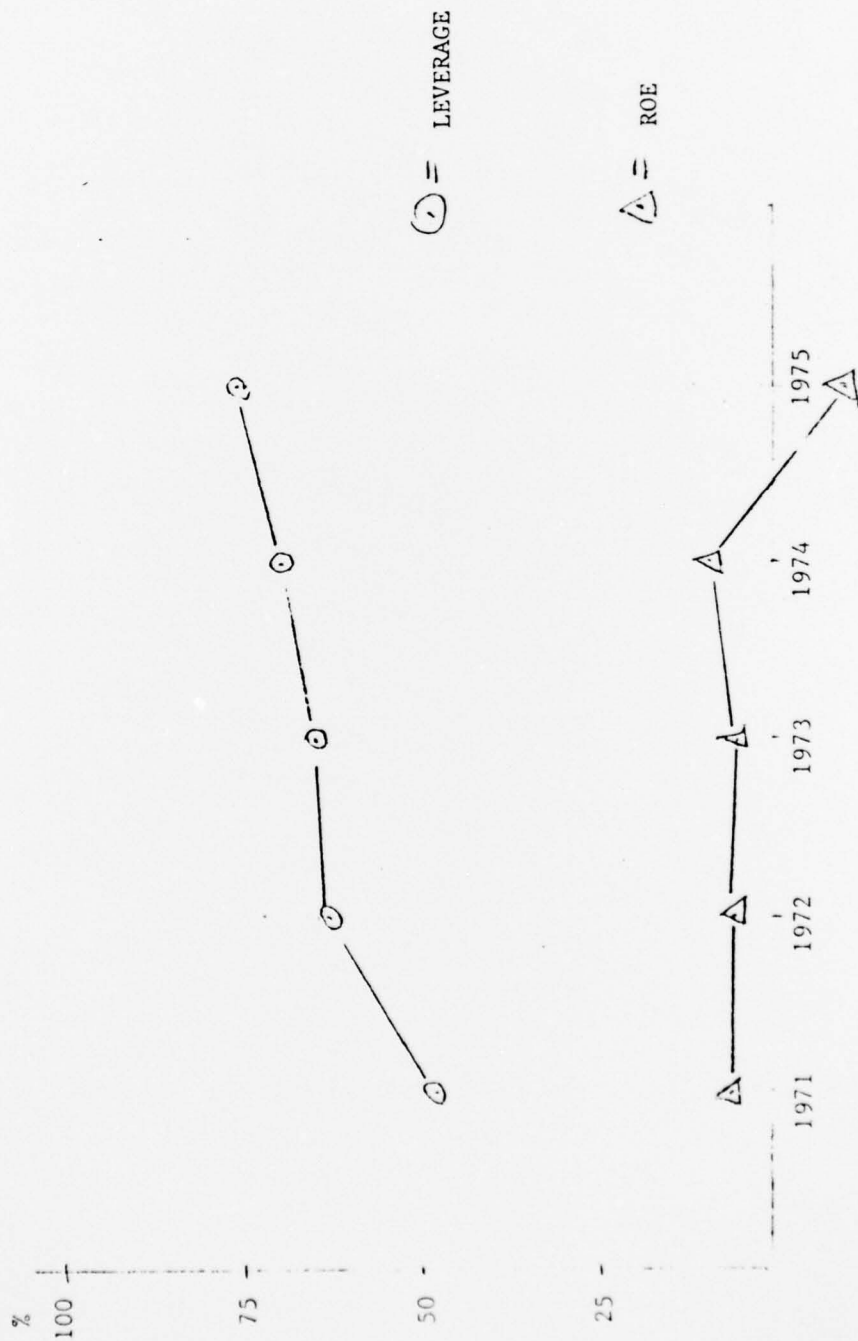
RCA CORPORATION



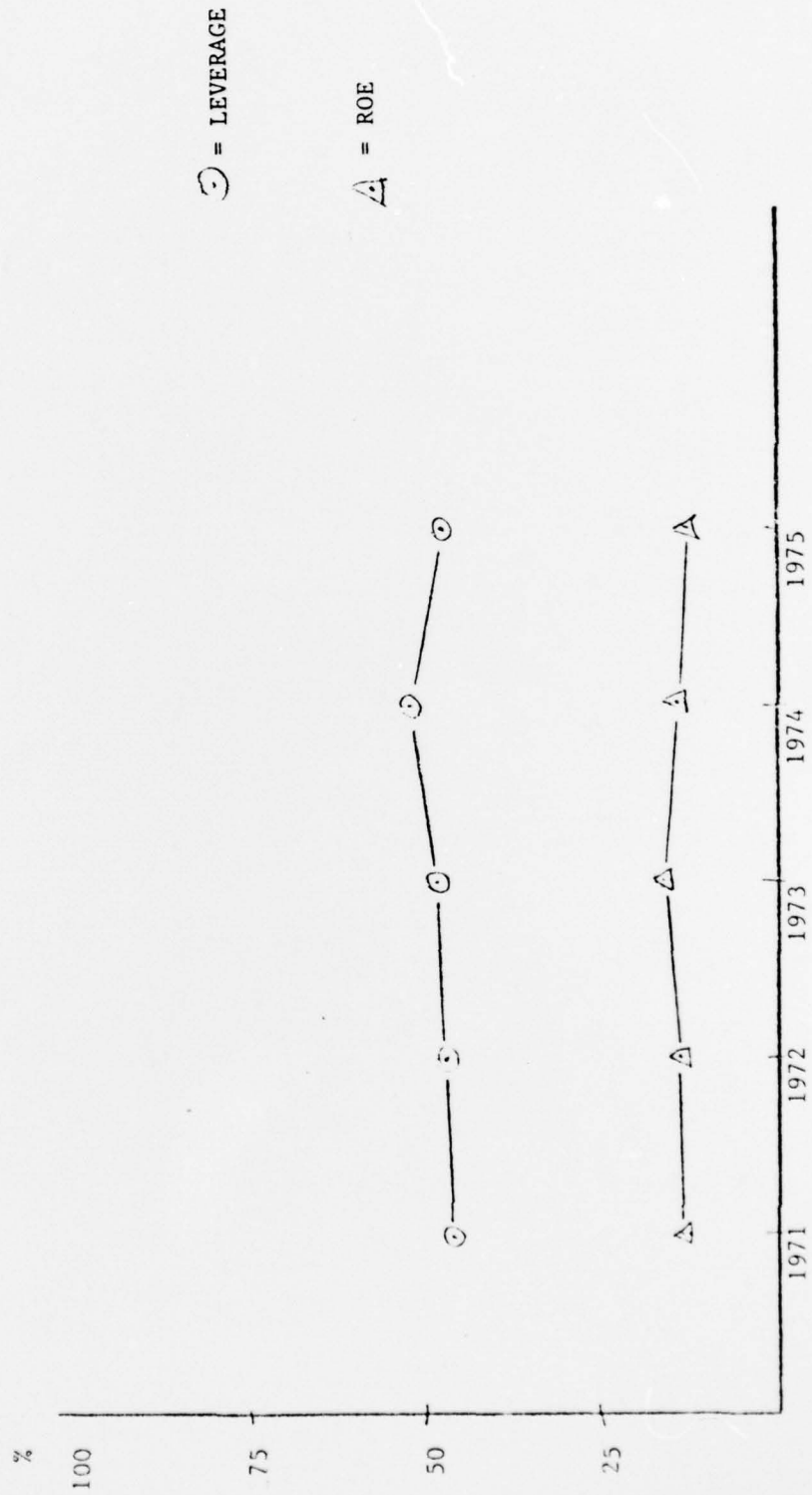
ROCKWELL



ROHR INDUSTRIES, INC.



TEXTRON



RANK CORRELATION CALCULATION # 1

<u>CORPORATION</u>	<u>ROE</u> (5 yrs)	<u>σ of ROE</u> (5 yrs)	<u>RANK</u>	<u>\bar{X} of L</u> (5 yrs)	<u>RANK</u>
LITTON	2.11%	4.69	9	61.62	10
TENNECO	10.76%	4.02	8	55.96	7.5
TODD	8.02%	16.34	12	55.94	7.5
HEWLETT-PACKARD	12.34%	1.7	3	27.20	2
TEKTRONICS	10.62%	1.92	4	26.36	1
NAT SEMICONDUCTOR	19.88%	9.78	11	52.8	5
TI	13.48%	3.29	6	41.1	3
RAYTHEON	13.40%	1.37	2	59.2	9
RCA	12.25%	3.45	7	67.78	11.5
ROCKWELL	10.40%	2.32	5	53.60	6
ROHR	3.68%	7.80	10	67.70	11.5
TEXTRON	14%	.99	1	48.56	4

D 1 -.5 -4.5 -1 -3 -6 -3 7 4.5 1 1.5 3

D² 1 .25 20.25 1 9 36 9 49 20.25 1 2.25 9

$$\sum D^2 = 158$$

then $r_{\text{RANK}} = 1 - \frac{6 \sum D^2}{N(N^2 - 1)} = 1 - \frac{6(158)}{12(12^2 - 1)} = .4476$

RANK CORRELATION CALCULATION # 2

<u>CORPORATION</u>	<u>σ of ROE (5 yrs)</u>	<u>RANK</u>	<u>\bar{X} of L (5 yrs)</u>	<u>RANK</u>
LITTON	4.6	8	61.62	7
TENNECO	4.02	7	55.96	5
TODD	Inadequate curve fit due to 1975 loss.		-	-
HEWLETT-PACKARD	1.7	2	27.20	1
TEKTRONICS	1.92	3	26.36	2
NAT SEMICONDUCTOR	Sharp Growth 72-75		-	-
TI	3.29	5	41.1	3
RAYTHEON	1.37	1	59.2	6
RCA	3.45	6	67.78	8.5
ROCKWELL	2.32	4	53.60	4
ROHR	7.8	9	67.70	8.5
TEXTRON	Wide diversification of Products masks profit centers.		-	-

D -1 -2 -1 -1 -2 5 2.5 0 .05

D² 1 4 1 1 4 25 6.25 0 .25

$$\sum D^2 = 42.5$$

$$r_{\text{RANK}} = 1 - \frac{6 \sum D^2}{N(N^2 - 1)} = 1 - \frac{6(42.5)}{9(81 - 1)} = .6500$$

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